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Frugality and fluorescence

Malcom's e-Spect, the world's first device combining fluorescence and absorption microscopy.

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Haruko Takeyama has an ambitious goal. The Waseda University scientist wants to analyze the genomes of microbial communities in corals and sponges and then use the obtained 'metagenomic' analyses for both industrial applications and as a monitor of global warming.

As 99% of such microbes cannot be cultured in the laboratory, Takeyama and her colleagues focus on genetic analyses using samples collected from the sea.

Metagenomic analyses turn up "many surprising and unknown things," says Takeyama. She has already found an important catalytic enzyme gene and other genes that mediate useful functions in the microbes. By tracking at the gene level how the microbial community changes over time, she expects to discover keys to understanding how the inhabitants of the coral ecological niche—including both bacteria, in which Takeyama specializes, and microalgae, such as zooxanthella—respond to environmental change. "Coral is a good indicator for environmental conditions, and it could be a very early warning of dramatic change," she says.

The coral metagenomics project, however, has encountered hurdles beyond the scientific challenge involved in analyzing and understanding the data. Sample availability also presents a snag. As the corals are subject to marine conservation provisions, Takeyama must obtain permission from the local government of Okinawa, the southern island region home to the coral reefs, to sample the corals. Even then, she must make do with tiny portions of as little as one cubic centimeter for each experiment.

A frugal approach is of importance not only in her coral studies. The biological samples used in her other research projects, such as human blood used for genotyping donor DNA and any viruses that may be present, come in preciously small amounts.

The fluorescence-labeled substrates used for screening enzymes in other metagenomics projects are also expensive. Samples of recombinant protein expressed by *E. coli* in the metagenome library are likewise available only in small amounts. "Now all researchers are figuring out ways to keep the detection volumes low," she says. "No-one wants to use up their samples."

Takeyama recently received a helping hand in facing these challenges from the e-Spect, a compact fluorescent spectroscopy device designed by Malcom Company Limited.

The e-Spect is unique. It can quantify expression levels of genes tagged with fluorescent markers in tiny samples of as small as 1.0 μlitre in Takeyama's laboratory. It is the only device that combines this ability to do fluorescence spectroscopy with the capacity for absorption spectroscopy.

With one machine doing the work of two, it is both cost-effective and compact. What makes it an even better fit for Takeyama's crowded laboratory is that, unlike competing models, it does not need to be connected to a computer to collect data.

Takeyama says the machine has been a popular addition to her laboratory, a bustling area within a new building dedicated to cutting-edge biomedical science. The sample in the e-Spect is sealed tightly within a quartz chamber. The chamber is a key factor in the reliability of this device, being more stable than in other models and thus not requiring yearly adjustment. The applicator lever prevents evaporation, allowing time-course analyses to be performed even with small sample volumes. "Many people from other labs come over to use it," she says.

Yet Takeyama will also be keeping the e-Spect busy. Her leadership in the field of genomic analyses has earned her industrial collaborations and grants from the Japanese government for her marine biotechnology work. The metagenomic studies have her exploring a broadly ranging field, from the natural diet of larval forms of spiny lobster and freshwater eel—research that could contribute to the development of better artificial feeds—to the genes for enzymes involved in biofuel production.

She attacks all these problems starting with genetic analyses, and they all require a reliable device like the e-Spect. "My research is always based on the gene," she says. "I don't want to change." ❑